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AUTHOR Creemers, Bert P. M.
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ABSTRACT

Two components of teaching are tasksetting behavior and optimizing behavior. The former is the actions of the teacher to achieve the goals of teaching a specific curriculum; the latter is the actions of the teacher to improve or accelerate the pupil's learning. Reading and physical education teachers were studied to investigate the relationship between the tasksetting behavior and measurements of the pupil's learning. The results of the investigations show that a significant relationship exists between certain behaviors and student achievement which does not appear to be different among groups of pupils with different entering behavior. (JMF)

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State University
Institute of Education
Department of Educational Research
Westerhaven 16
Groningen
The Netherlands

U.S. DEPARTMENT OF HEALTH, EDUCATION & WELFARE
NATIONAL INSTITUTE OF EDUCATION

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The Relationship between tasksetting teaching behaviour and pupil achievement

Bert P.M. Creemers

Abstract

Teaching behaviour is distinguished in tasksetting and optimizing behaviour.
Tasksetting behaviour: actions of the teacher to achieve the goals of teaching a specific curriculum.
Optimizing behaviour: actions of the teacher to improve or accelerate the pupil's learning.
In initial reading and physical education groups of teachers can be distinguished with the same tasksetting behaviour. The relationship is investigated between this tasksetting behaviour and (norm and criterion referenced) measurements of the pupil's learning. The results of the investigations show that a significant relationship exists which, generally spoken, does not appear to be different among groups of pupils with different entering behaviour. In the case of initial reading we analysed the relation between tasksetting and optimizing behaviour of the teachers and characteristics of pupils (sex, intelligence and reading motivation) on the one side and reading achievement, as measured by criterion and norm referenced on the other. The results indicate significant but unimportant relations between tasksetting and optimizing behaviours on the one side and reading achievement on the other side.
For an explanation of the scores obtained the performance on the preceding criterion test, i.e. the group of the preceding learning tasks, appeared to be much more important for explaining reading achievement.

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1. Research in teacher effectiveness

In the past there has been a lot of research to establish the influence of specific personality variables of teachers or activities such as verbal behaviour the teachers perform in the classroom on the achievements of pupils.

The results of this research are, as appear from the reviews of Rosenshine (1971 a, b, c), Rosenshine & Furst (1971, 1973) and Gage (1972) extremely disappointing. According to Rosenshine & Furst (1973) only a limited number of variables can be considered worthly of further investigation. Among others Rosenshine (1973), Bloom (1972) and Davies (1972) state that research should, in future, be directed towards what teachers do.

2. Hypotheses

When research has to be directed on concrete teaching behaviour, this has to be done in relation with the subject matter. Therefor we look at teaching behaviour within a specific subject matter such as a curriculum or a method. Although there are big differences between curricula and methods, each curriculum or method intends somehow to suggest or prescribe the teaching activities. These teaching activities are directed on the learning of the pupils within this specific curriculum or method. Besides these activities the teacher maintains the learning situation, the classroom climate and so on. According to these considerations we make a distinction between two different components of teaching. The first component consists of task-setting teaching behaviour, the second component refers to optimizing teaching behaviour.

The tasksetting component includes the actions executed by a teacher through which in his opinion he will be able to fulfil, according to the curriculum or method, the goals of teaching a specific subject matter. The optimizing component consists of the actions whereby the teacher is able to improve on or accelerate the learning process. We hypothesize that there will be groups of teachers who show the same tasksetting behaviour, that is: they will have the same teaching style.

Perhaps there is a relationship between the teaching style and the optimizing component, but that is not clearly defined. For the time being we consider them as being separate from eachother. We assume that the teachers with the same teaching style have not necessarily the same optimizing behaviour.

Furthermore we suppose that the differences in teaching style, within a group of teachers, lead to differences in pupil achievement which cannot be fully accounted for by initial differences in pupil's entering behaviour.

Until now two research projects have been carried out to test this theoretical framework. One in initial reading, the other one in physical education.

3. Teaching behaviour within initial reading

3.1 Procedure

For the investigation of teaching behaviour two instruments were developed.

- An observation scale for studying the tasksetting behaviour. The categories (tasksettings) were derived from an analysis of a specific method for initial reading.
  (For example:
  1. The teacher let the children speak with sharpened articulation.
  2. The teacher asks/explains the meaning of a word).
  The reliability of the scale appeared to be reasonably high (about 90).
- A rating scale was developed for studying the optimizing components. The items of the rating scale were based upon the reviews of Rosenshine & Furst. Originally the rating scale consisted of 35 items. After psychometric analysis only 13 items were retained. The discriminative power and reliability of these items were, as can be expected, high. In the factor analysis we distinguish 3 factors: teacher's warmth (bipolar with criticism), organisation (structuring the lesson for the pupils) and the promotion by the teacher of the endeavour between pupils. For the investigation of the pupils the following tests were used.
- For measuring the entering behaviour we used a test for intelligence. We developed a test for the investigation of pupil's motivation in reading. Furthermore we got information about sex and the social economic status.
- For measuring the achievements of the pupils we used norm- and criterion referenced tests. Besides that we got information about pupil's motivation for reading.

The investigation included 31 teachers and 670 pupils. From each teacher 35 lessons were observed during the first 6 months of reading instruction in the first grade. Evaluation of pupil achievement took place several times in that half year.

3.2 Results

For each of the teachers a standard lesson was established on account of the data of the 35 observed lessons. Then a cluster analysis was carried out on the standard lessons of the 31 teachers in order to establish the groups of teachers which contained the most similarities qua test setting behaviour.

The cluster analysis distinguished definit groups of teachers (see figure 1 and table 1).

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insert table 1 and figure 1 about here

The analysis was continued with those teachers who could be allocated to a specific group. Eight groups could be distinguished. (see table 2)

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insert table 2 about here

For each group of teachers a profile of the standard lesson was computed. A description of this profile is the content of the teaching style.

For example:

Teaching style 4:

This teaching style pays less attention at reading and exercises which support reading. The main emphasis is put on language development.

Teaching style 6:

This teaching style is characterized by the great emphasis on analysis of new words into their components. There is not much attention for language development, the learning of new words and the blending of letters or sounds into words.

For a description of all the 8 teaching styles within initial reading by this specific method see appendix I.

There was no agreement as regards the optimizing component between teachers who taught with the same teaching style. The similarities

and differences in optimizing behaviour cut across the different teaching styles.

Next we have investigated whether or not the differences in teaching style within a group of teachers, lead to differences in pupil achievement which cannot be fully accounted for by initial differences in pupil's entering behaviour. This analysis by means of multivariate analysis of variance was carried out separately for each of the characteristics in the entering behaviour of the pupils i.e.: sex, social economic class and intelligence. In case of the motivation for reading, which was regarded as one of the characteristics in the entering behaviour and as a result of the learning process, we used multivariate analysis of covariance. These analysises were also carried out separately for 4 groups of tests:

- criterion-referenced tests for technical reading
- norm referenced tests for reading
- tests for reading comprehension
- language development (one of the goals of the reading curriculum in the Netherlands).

Testing of hypothesis took place on three levels:

1. On the first level is established whether the effects of teaching style deviate significantly from O. If so, then:
2. On the second level is investigated whether the effect of a specific teaching style minus the effect of each subsequent teaching style differs significantly from O. If so, then:
3. On the third level the effect of each teaching style is compared individually with every subsequent teaching style.

For example the tables 3, 4, 5 and 6 give the results of the MANOVA with sex as pupil characteristic.

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insert tables 3, 4, 5 and 6 about here

On the first level the effect of teaching style mostly appears to be significant at the 1% level. A number of significant results were also obtained on the second and third level.

This indicates that the effect of specific teaching styles minus the effect of subsequent teaching styles differs significantly from O. These other teaching styles are distinguished from each other on the basis of their effect.

On the third level the effects of certain teaching styles appear to be similar in their significant/non-significant differences with regard to other teaching styles.

This is however not consistent among either the different categorization criteria or the different groups.

A significant teaching effect also appears in the reading attitude.

The interaction-effect of teaching style and the pupil characteristics (entering behaviour) does not, on the whole, deviate from O.

It can be assumed that the teaching style is responsible for the significance and non-significance of the pupil's achievements*1.

3.3 Conclusion

It appears that teachers can be distinguished into groups on grounds of their tasksetting behaviour (teaching style).

- A relationship exists between these teaching styles and achievements of pupils.
- Such relationship generally do not appear to be different among groups of pupils with different entering behaviour.

4. Teaching behaviour within physical education*2

In this investigation not one specific method was involved, but different methods which deal with a specific part of the curriculum for physical education: i.e. swinging in the rings.

For the observation of the tasksetting component a scale was constructed which was usable for the study of different teaching methods. For the study of the optimizing behaviour use was made of the rating scale we

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*1 For who are interested in initial reading:
Generally spoken teaching styles 1, 3, 7 and 8 lead to lower pupil achievements than the other styles. Teaching style 8 also leads to lower results on the reading attitude scale. It seems to be that teaching which includes a low frequency of tasksettings or teaching that puts the only accent on reading by the children self leads to inferior results.

*2 This research project was carried out by Drs Erik Smuling and Drs Jan van Lier under supervision of Dr Pieter Span and the author.

constructed in the initial reading project. In these research projects 15 teachers, each in 4 lessons were observed.
The computation of the standard lesson was carried out in the same way as mentioned in the initial reading study.
For the grouping of the teachers a Mc Quitty procedure was used. In this investigation too it was possible to distinguish groups of teachers with a different teaching style, based on tasksetting behaviour.
For measuring the pupil's achievement a norm referenced test was used.
In the group of pupils on account of the test for enabling behaviour a distinction has been made between pupils who are structuring the learning task (within) and them who do'nt.
The results of the ANOVA are shown in table 7.

insert table 7 about here

The conclusion can be made that the teaching style is nearly significant although it is n't.*1

5. A secondary analysis*2 discussion

5.1 Procedure

The results of the studies, mentioned above, indicate that it will be worthwhile to continue the investigation of teaching behaviour within the same content that is: teaching the same subject matter by means of a specific curriculum or method.
To get more information about the contributions of the tasksettings to the learning of the pupils a step-wise regression analysis was carried out on the data from the initial reading study. We analysed the relation between tasksetting and optimizing behaviour of teachers and characteristics of pupils (sex, intelligence and reading motivation) on the one side and reading achievement as measured by the 7 criterion referenced tests on the other.
Step-wise regression analysis with forward inclusion and the possibility of removal of already entered variables (at each step) was used.

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*1 It has to be mentioned that the groups of teachers, based upon the optimizing component, differ from each other significant at the .01 level with relation to the pupil achievements.

*2 The secondary analysis was done by Drs Jan Slavenburg and the author.

The tables 8, 9 and 10 give briefly the results of the analysis on criteriontest 1, 2 and 5. The results are given in the form of standardized regressioncoefficients (B), on behalf of the possibility to compare them and in the form of squared multiple correlation coefficients.

insert tables 8 - 10 about here

5.2 Discussion

If we look at the explaining value of the tasksettings we have to conclude that the value from the separate tasksetting is very small. This is the case for almost all the possible tasksettings. There are little differences between the tasksettings but these are not consistent. For obtaining the goals, such as measured by the criterion-referenced tests the tasksettings are of little importance.
This means that the assumptions of the secondary analysis were not met; but we can make other conclussions. Teaching style and some tasksettings are significant, they have a significant influence on the pupil's achievement, but in practice they are of little importance.
Like Bloom (1974) supposed we found that the influence of intelligence is decreasing and the importance of the preceding criterion referenced tests is increasing. This means that the results on a previous criterion test are a predictor of the learning time of the succeeding unit and, if we take the learning time constant, of the results. These tests do'nt measure the same skills but a development from an entering behaviour to more complex skills. These conclussions suggest that it is worthwhile to try an experiment in teaching reading by the way of mastery learning. Then we can give a reinterpretation of the tasksetting behaviour of the teacher. This contains that we relate the different tasksettings to the subskills, which lead to the goals/skills of a learning unit. The question remains whether it is worth the money, time and manpower to make such a profound study of each curriculum and method as we undertook in these cases and still have to do.
I think there is an other way of approaching the problem. I propose

to make a better use of the teacher's guide which accompanies the learning materials. In their present form these guides often give only more or less comprehensive directions for the teaching behaviour. I think that if these guides would give more information concerning goals, processes and tasksettings of the method the possibility that less suitable or even incorrect teaching styles are generated by the teacher, is minimalized. Such information sets clear boundaries for successful teaching behaviour, even if the teacher does not know all possible teaching styles.

In this case one may even avoid one of the most striking results of the initial reading investigation, i.e. that most teachers use only a very few number of the prescribed tasksettings. Each individual teacher in this investigation uses only the half of the possible tasksettings. I think one has to make clear for teachers that the teaching of reading is more than they think at this moment. Then maybe there will be a differentiated teaching behaviour within the limits of a specific curriculum and method even if this is in the way of mastery learning.

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Table 1 Results of a hierarchical cluster analysis on a mean squared distance matrix

Cluster	1e participant	2e participant	intra-cluster MSD	number of teachers
1001	25	27	3.34	2
1002	12	18	3.46	2
1003	17	21	3.64	2
1004	1003	22	4.15	3
1005	5	10	4.33	2
1006	16	1001	4.34	3
1007	1002	1006	4.87	5
1008	7	28	5.88	2
1009	13	30	5.96	2
1010	29	1004	5.12	4
1011	26	1009	6.71	3
1012	4	11	7.09	2
1013	23	24	7.68	2
1014	19	31	8.05	2
1015	2	1011	7.43	4
1016	1007	1010	6.94	9
1017	6	1014	9.44	3
1018	1015	1016	8.66	13
1019	3	1013	9.76	3
1020	1	1008	9.58	3
1021	1017	1018	9.61	16
1022	20	1012	10.34	3
1023	9	1005	10.36	3
1024	1020	1021	10.68	19
1025	8	1022	14.91	4
1026	1019	1024	11.66	22
1027	1023	1025	15.11	7
1028	14	1026	12.20	23
1029	1027	1028	17.06	30
1030	15	1029	18.35	31

Table 2 Distinguished teacher groups (on account of differences in the frequency of task settings

Teacher group	Clusternumber	number of teachers
1	1007	5
2	1010	4
3	1015	4
4	1017	3
5	1020	3
6	1019	3
7	1022	3
8	1005	2

Table 3 Results of the testing of hypotheses for teaching style x sex x achievements of pupils on criterion-referenced tests.

Hypotheses	df		F-ratio
first level			
1. H_0: Sex-, style- and interaction effect = 0	105	3274	2.14**
2. H_0: Interaction effect = 0	49	2594	1.41*
3. H_0: Sex effect = 0	7	510	3.84**
4. H_0: Teaching style effect = 0	49	2594	2.67**
second level			
5. H_0: $\begin{pmatrix}\alpha_1 - \alpha_2\\ \alpha_1 - \alpha_8\end{pmatrix} = 0$	49	2594	2.67**
6. H_0: $\begin{pmatrix}\alpha_2 - \alpha_3\\ \alpha_2 - \alpha_8\end{pmatrix} = 0$	42	2396	2.62**
7. H_0: $\begin{pmatrix}\alpha_3 - \alpha_4\\ \alpha_3 - \alpha_8\end{pmatrix} = 0$	35	2148	2.89**
8. H_0: $\begin{pmatrix}\alpha_4 - \alpha_5\\ \alpha_4 - \alpha_8\end{pmatrix} = 0$	28	1840	2.21**
9. H_0: $\begin{pmatrix}\alpha_5 - \alpha_6\\ \alpha_5 - \alpha_8\end{pmatrix} = 0$	21	1465	2.27**
10. H_0: $\begin{pmatrix}\alpha_6 - \alpha_7\\ \alpha_6 - \alpha_8\end{pmatrix} = 0$	14	1020	2.17**
11. H_0: $\alpha_7 - \alpha_8 = 0$	7	510	1.87
third level			
12. H_0: $\alpha_1 - \alpha_2 = 0$	7	510	3.83**
13. H_0: $\alpha_1 - \alpha_3 = 0$	7	510	.71
14. H_0: $\alpha_1 - \alpha_4 = 0$	7	510	3.72**
15. H_0: $\alpha_1 - \alpha_5 = 0$	7	510	3.92**
16. H_0: $\alpha_1 - \alpha_6 = 0$	7	510	3.14**
17. H_0: $\alpha_1 - \alpha_7 = 0$	7	510	2.26*
18. H_0: $\alpha_1 - \alpha_8 = 0$	7	510	2.55*

Hypotheses		df		F ratio
19.	$H_0 : \alpha_2 - \alpha_1 = 0$	7	510	5.26**
20.	$H_0 : \alpha_2 - \alpha_4 = 0$	7	510	1.12
21.	$H_0 : \alpha_2 - \alpha_5 = 0$	7	510	.93
22.	$H_0 : \alpha_2 - \alpha_6 = 0$	7	510	1.90
23.	$H_0 : \alpha_2 - \alpha_7 = 0$	7	510	1.81
24.	$H_0 : \alpha_2 - \alpha_8 = 0$	7	510	1.18
25.	$H_0 : \alpha_3 - \alpha_4 = 0$	7	510	5.27**
26.	$H_0 : \alpha_3 - \alpha_5 = 0$	7	510	5.65**
27.	$H_0 : \alpha_3 - \alpha_6 = 0$	7	510	3.82**
28.	$H_0 : \alpha_3 - \alpha_7 = 0$	7	510	2.41*
29.	$H_0 : \alpha_3 - \alpha_8 = 0$	7	510	3.01**
30.	$H_0 : \alpha_4 - \alpha_5 = 0$	7	510	1.83
31.	$H_0 : \alpha_4 - \alpha_6 = 0$	7	510	3.16**
32.	$H_0 : \alpha_4 - \alpha_7 = 0$	7	510	1.50
33.	$H_0 : \alpha_4 - \alpha_8 = 0$	7	510	1.98
34.	$H_0 : \alpha_5 - \alpha_6 = 0$	7	510	2.25*
35.	$H_0 : \alpha_5 - \alpha_7 = 0$	7	510	2.67**
36.	$H_0 : \alpha_5 - \alpha_8 = 0$	7	510	2.10*
37.	$H_0 : \alpha_6 - \alpha_7 = 0$	7	510	2.42*
38.	$H_0 : \alpha_6 - \alpha_8 = 0$	7	510	2.19*

* significant at .05 level
** significant at .01 level

Table 4 Results of the testing of hypotheses for teaching style x sex x achievements of pupils on norm-referenced tests.

Hypotheses	df		F-ratio
first level			
1. H_0: Sex-, style- and interaction effect = 0	45	1569	3.29**
2. H_0: Interaction effect = 0	21	1517	1.48
3. H_0: Sex effect = 0	5	528	5.39**
4. H_0: Teaching style effect = 0	21	1517	4.68**
second level			
5. $H_0: \begin{pmatrix} \alpha_1 - \alpha_2 \\ \alpha_1 - \alpha_8 \end{pmatrix} = 0$	21	1517	4.68**
6. $H_0: \begin{pmatrix} \alpha_2 - \alpha_3 \\ \alpha_2 - \alpha_8 \end{pmatrix} = 0$	18	1494	4.75**
7. $H_0: \begin{pmatrix} \alpha_3 - \alpha_4 \\ \alpha_3 - \alpha_8 \end{pmatrix} = 0$	15	1458	5.07**
8. $H_0: \begin{pmatrix} \alpha_4 - \alpha_5 \\ \alpha_4 - \alpha_8 \end{pmatrix} = 0$	12	1397	4.85**
9. $H_0: \begin{pmatrix} \alpha_5 - \alpha_6 \\ \alpha_5 - \alpha_8 \end{pmatrix} = 0$	9	1285	4.82**
10. $H_0: \begin{pmatrix} \alpha_6 - \alpha_7 \\ \alpha_6 - \alpha_8 \end{pmatrix} = 0$	6	1056	3.61**
11. $H_0 : \alpha_7 - \alpha_8 = 0$	3	528	1.67
third level			
12. $H_0 : \alpha_1 - \alpha_2 = 0$	3	528	6.90**
13. $H_0 : \alpha_1 - \alpha_3 = 0$	3	528	.83
14. $H_0 : \alpha_1 - \alpha_4 = 0$	3	528	3.54*
15. $H_0 : \alpha_1 - \alpha_5 = 0$	3	528	10.77**
16. $H_0 : \alpha_1 - \alpha_6 = 0$	3	528	6.39**
17. $H_0 : \alpha_1 - \alpha_7 = 0$	3	528	2.72*
18. $H_0 : \alpha_1 - \alpha_8 = 0$	3	528	.77

Hypotheses		df	F-ratio
19.	$H_0 : \alpha_2 - \alpha_3 = 0$	3 528	5.82**
20.	$H_0 : \alpha_2 - \alpha_4 = 0$	3 528	6.75**
21.	$H_0 : \alpha_2 - \alpha_5 = 0$	3 528	1.12
22.	$H_0 : \alpha_2 - \alpha_6 = 0$	3 528	1.99
23.	$H_0 : \alpha_2 - \alpha_7 = 0$	3 528	5.55**
24.	$H_0 : \alpha_2 - \alpha_8 = 0$	3 528	3.44*
25.	$H_0 : \alpha_3 - \alpha_4 = 0$	3 528	6.32**
26.	$H_0 : \alpha_3 - \alpha_5 = 0$	3 528	8.41**
27.	$H_0 : \alpha_3 - \alpha_6 = 0$	3 528	5.26**
28.	$H_0 : \alpha_3 - \alpha_7 = 0$	3 528	4.74**
29.	$H_0 : \alpha_3 - \alpha_8 = 0$	3 528	1.94
30.	$H_0 : \alpha_4 - \alpha_5 = 0$	3 528	10.89**
31.	$H_0 : \alpha_4 - \alpha_6 = 0$	3 528	6.84**
32.	$H_0 : \alpha_4 - \alpha_7 = 0$	3 528	.59
33.	$H_0 : \alpha_4 - \alpha_8 = 0$	3 528	1.17
34.	$H_0 : \alpha_5 - \alpha_6 = 0$	3 528	2.67*
35.	$H_0 : \alpha_5 - \alpha_7 = 0$	3 528	9.16**
36.	$H_0 : \alpha_5 - \alpha_8 = 0$	3 528	6.57**
37.	$H_0 : \alpha_6 - \alpha_7 = 0$	3 528	4.07**
38.	$H_0 : \alpha_6 - \alpha_8 = 0$	3 528	4.96**

* significant at .05 level
** significant at .01 level

Table 5 Results of the testing of hypotheses for teaching style x sex x achievements of pupils on a reading comprehension test.

Hypotheses	df		F-ratio
first level			
1. H_0: Sex-, style- and interaction effect = 0	15	562	4.12**
2. H_0: Interaction effect = 0	7	562	1.32
3. H_0: Sex effect = 0	1	562	8.78**
4. H_0: Teaching style effect = 0	7	562	4.22**
second level			
5. $H_0 \begin{pmatrix} \alpha_1 - \alpha_2 \\ \alpha_1 - \alpha_8 \end{pmatrix} = 0$	7	562	4.22**
6. $H_0 : \begin{pmatrix} \alpha_2 - \alpha_3 \\ \alpha_2 - \alpha_8 \end{pmatrix} = 0$	6	562	3.69**
7. $H_0 : \begin{pmatrix} \alpha_3 - \alpha_4 \\ \alpha_3 - \alpha_8 \end{pmatrix} = 0$	5	562	3.88**
8. $H_0 : \begin{pmatrix} \alpha_4 - \alpha_5 \\ \alpha_4 - \alpha_8 \end{pmatrix} = 0$	4	562	1.39
9. $H_0 : \begin{pmatrix} \alpha_5 - \alpha_6 \\ \alpha_5 - \alpha_8 \end{pmatrix} = 0$	3	562	1.85
10. $H_0 : \begin{pmatrix} \alpha_6 - \alpha_7 \\ \alpha_6 - \alpha_8 \end{pmatrix} = 0$	2	562	1.02
11. $H_0 : \alpha_7 - \alpha_8 = 0$	1	562	.05
third level			
12. $H_0 : \alpha_1 - \alpha_2 = 0$	1	562	9.74**
13. $H_0 : \alpha_1 - \alpha_3 = 0$	1	562	.61
14. $H_0 : \alpha_1 - \alpha_4 = 0$	1	562	5.58*
15. $H_0 : \alpha_1 - \alpha_5 = 0$	1	562	11.87**
16. $H_0 : \alpha_1 - \alpha_6 = 0$	1	562	2.68
17. $H_0 : \alpha_1 - \alpha_7 = 0$	1	562	2.20
18. $H_0 : \alpha_1 - \alpha_8 = 0$	1	562	1.24

Hypotheses		df		F-ratio
19.	$H_0 : \alpha_2 - \alpha_3 = 0$	1	562	13.13**
20.	$H_0 : \alpha_2 - \alpha_4 = 0$	1	562	.18
21.	$H_0 : \alpha_2 - \alpha_5 = 0$	1	562	.41
22.	$H_0 : \alpha_2 - \alpha_6 = 0$	1	562	1.51
23.	$H_0 : \alpha_2 - \alpha_7 = 0$	1	562	1.30
24.	$H_0 : \alpha_2 - \alpha_8 = 0$	1	562	1.72
25.	$H_0 : \alpha_3 - \alpha_4 = 0$	1	562	8.34**
26.	$H_0 : \alpha_3 - \alpha_5 = 0$	1	562	15.24**
27.	$H_0 : \alpha_3 - \alpha_6 = 0$	1	562	3.01
28.	$H_0 : \alpha_3 - \alpha_7 = 0$	1	562	4.17*
29.	$H_0 : \alpha_3 - \alpha_8 = 0$	1	562	2.77
30.	$H_0 : \alpha_4 - \alpha_5 = 0$			
31.	$H_0 : \alpha_4 - \alpha_6 = 0$	could not be tested because H_0 8 could not be rejected		
32.	$H_0 : \alpha_4 - \alpha_7 = 0$			
33.	$H_0 : \alpha_4 - \alpha_8 = 0$			
34.	$H_0 : \alpha_5 - \alpha_6 = 0$			
35.	$H_0 : \alpha_5 - \alpha_7 = 0$	could not be tested because H_0 9 could not be rejected		
36.	$H_0 : \alpha_5 - \alpha_8 = 0$			
37.	$H_0 : \alpha_6 - \alpha_7 = 0$	could not be tested because H_0 10 could not be rejected		
38.	$H_0 : \alpha_6 - \alpha_8 = 0$			

* significant at .05 level
** significant at .01 level

Table 6 Results of the testing of hypotheses for teaching style x sex x achievements of pupils on language tests.

Hypotheses	df		F-ratio
first level			
1. H_0: Sex-, style- and interaction effect = 0	30	1042	2.65**
2. H_0: Interaction effect = 0	14	1042	.70
3. H_0: Sex effect = 0	2	521	7.87**
4. H_0: Teaching style effect = 0	14	1042	3.86**
second level			
5. $H_0: \begin{pmatrix} \alpha_1 - \alpha_2 \\ \alpha_1 - \alpha_8 \end{pmatrix} = 0$	14	1042	3.86**
6. $H_0: \begin{pmatrix} \alpha_2 - \alpha_3 \\ \alpha_2 - \alpha_8 \end{pmatrix} = 0$	12	1042	3.29**
7. $H_0: \begin{pmatrix} \alpha_3 - \alpha_4 \\ \alpha_3 - \alpha_8 \end{pmatrix} = 0$	10	1042	3.39**
8. $H_0: \begin{pmatrix} \alpha_4 - \alpha_5 \\ \alpha_4 - \alpha_8 \end{pmatrix} = 0$	8	1042	2.57**
9. $H_0: \begin{pmatrix} \alpha_5 - \alpha_6 \\ \alpha_5 - \alpha_8 \end{pmatrix} = 0$	6	1042	1.92
10. $H_0: \begin{pmatrix} \alpha_6 - \alpha_7 \\ \alpha_6 - \alpha_8 \end{pmatrix} = 0$	4	1042	1.71
11. $H_0: \alpha_7 - \alpha_8 = 0$	2	521	.34
third level			
12. $H_0: \alpha_1 - \alpha_2 = 0$	2	521	9.51**
13. $H_0: \alpha_1 - \alpha_3 = 0$	2	521	.33
14. $H_0: \alpha_1 - \alpha_4 = 0$	2	521	11.38**
15. $H_0: \alpha_1 - \alpha_5 = 0$	2	521	7.55**
16. $H_0: \alpha_1 - \alpha_6 = 0$	2	521	5.53**
17. $H_0: \alpha_1 - \alpha_7 = 0$	2	521	.91
18. $H_0: \alpha_1 - \alpha_8 = 0$	2	521	.0

Hypotheses		df		F-ratio
19. $H_0 : \alpha_2 - \alpha_3 = 0$		2	521	8.50**
20. $H_0 : \alpha_2 - \alpha_4 = 0$		2	521	1.86
21. $H_0 : \alpha_2 - \alpha_5 = 0$		2	521	.08
22. $H_0 : \alpha_2 - \alpha_6 = 0$		2	521	1.36
23. $H_0 : \alpha_2 - \alpha_7 = 0$		2	521	2.65
24. $H_0 : \alpha_2 - \alpha_8 = 0$		2	521	3.19*
25. $H_0 : \alpha_3 - \alpha_4 = 0$		2	521	9.49**
26. $H_0 : \alpha_3 - \alpha_5 = 0$		2	521	7.23**
27. $H_0 : \alpha_3 - \alpha_6 = 0$		2	521	4.20*
28. $H_0 : \alpha_3 - \alpha_7 = 0$		2	521	1.07
29. $H_0 : \alpha_3 - \alpha_8 = 0$		2	521	1.66
30. $H_0 : \alpha_4 - \alpha_5 = 0$		2	521	2.22
31. $H_0 : \alpha_4 - \alpha_6 = 0$		2	521	1.41
32. $H_0 : \alpha_4 - \alpha_7 = 0$		2	521	5.11**
33. $H_0 : \alpha_4 - \alpha_8 = 0$		2	521	6.58**
34. $H_0 : \alpha_5 - \alpha_6 = 0$	could not be tested because H_0 9 could not be rejected			
35. $H_0 : \alpha_5 - \alpha_7 = 0$				
36. $H_0 : \alpha_5 - \alpha_8 = 0$				
37. $H_0 : \alpha_6 - \alpha_7 = 0$	could not be tested because H_0 10 could not be rejected			
38. $H_0 : \alpha_6 - \alpha_8 = 0$				

* significant at .05 level
** significant at .01 level

Table 7. Results of the ANOVA

Source	SS	df	MS	$F = MS./MS_{error}$
A	5,88	1	5,88	3,38
B	19,68	5	3,94	2,26
AB	15,84	5	3,17	1,82
Error	111,36	64	1,74	

A: structuring/non-structuring behaviour of pupils

B: teaching style

Table 8. Fxplanation of the achievements on criterion-referenced test

1 (N=553)

step	variable	standardized regression coefficient β	$P(\beta_o=C)$	multiple R^2	increase of R^2
1	intelligence	.380	.000	.156	.156
2	reading with lengthening of the sounds	.146	.000	.187	.031
3	teaching the notion of what is read	-.302	.005	.222	.035
⋮	⋮	⋮	⋮	⋮	⋮
16	writing-teacher	.105	.139	.298	.003
17	narrating-teacher	-.073	.179	.300 *)	.002

*) P(R) <.025

Table 9. Explanation of the achievements on criterion-referenced test ≠≠ 2 (N = 499)

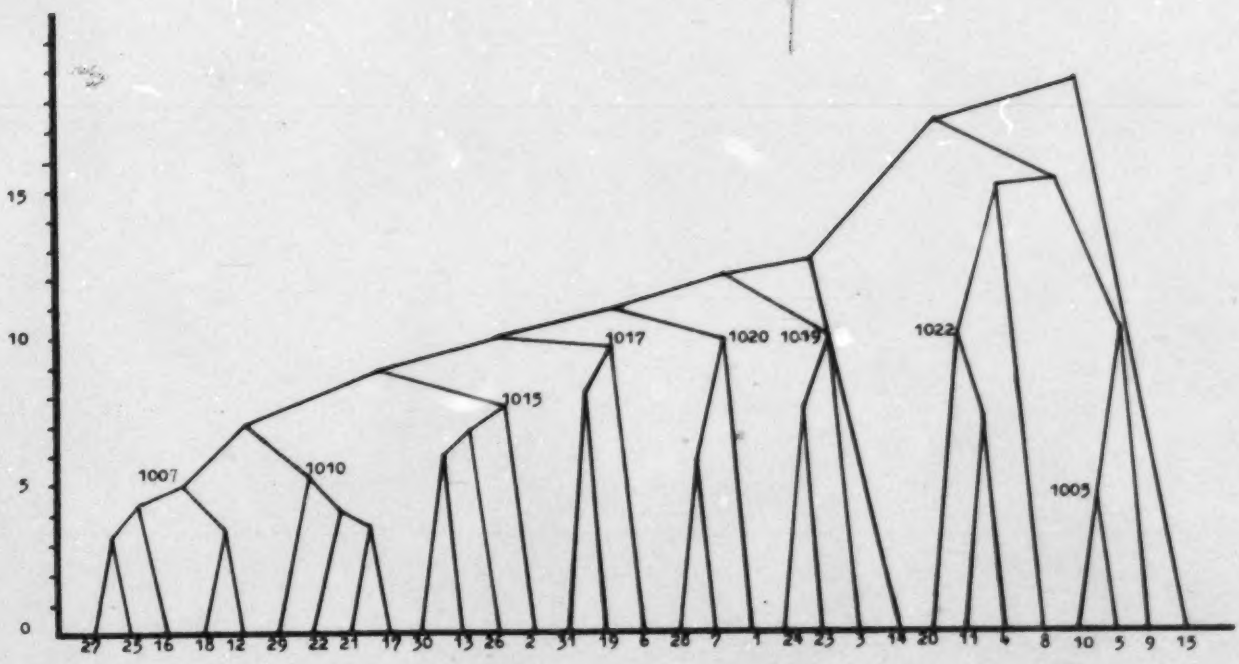
step	variable	standardized regression coëfficient β	$P(\beta_o=0)$	multiple R^2	increase of R^2
1	criterion referenced test ≠≠ 1	.572	.000	.426	.426
2	teacher's warmth (factor ≠≠ 1 in the optimizing behaviour)	-.152	.000	.471	.045
3	intelligence	.134	.000	.499	.028
⋮	⋮	⋮	⋮	⋮	⋮
17	reading of new words	-.084	.150	.562 ⁎)	.002

⁎) P(R) <.025

Table 10. Explanation of the achievements on criterion-referenced test ≠≠ 5 (N = 499)

step	variable	standardized regression coëfficient β	$P(\beta_o=0)$	multiple R^2	increase of R^2
1	criterion referenced test ≠≠ 4	.634	.000	.752	.752
2	criterion referenced test ≠≠ 3	.296	.000	.784	.032
3	analysis of new words	-.195	.003	.788	.004
⋮	⋮	⋮	⋮	⋮	⋮
19	reading-teacher	-.037	.168	.815 *)	.001

*) P(R) < .025



Figuur 1. Diagram of the results of a hierarchical clusteranalysis on a mean squared distance matrix.

Appendix I

Teaching style 1.

The teaching behaviour of this style is characterized by the fact that there are, in comparison with the other styles, less task settings concerning the reading of the children but more task settings concerning the writing of the children.

In general there are few task settings directed at the learning, analysing and synthesizing new words.

The auditory aspect of the task settings gets only few attention.

Task settings directed at the learning of the language also happen only a few times.

Teaching style 2

This teaching style is characterized by a strong emphasis on the reading of the children self. Task settings directed at the learning of new words, the analysis and synthesis of these new words only happen a few times.

The accent in analysis and synthesis lies on the visual aspects and also tasks for associate learning. Here too there is a relative lack of attention for language learning.

Teaching style 3

This teaching style is characterized by the fact that the teacher not only gives task settings on reading and writing but also sets tasks directed on the learning of new words and the analysis and synthesis of these words. There is also attention for technical exercises, which may be support the learning of reading.

Teaching style 4

This teaching style pays less attention at reading and exercises which support reading. The main emphasis lies on language development.

Teaching style 5

This style includes teaching behaviour characterized by task setting which concern the writing by teachers and children. Other task settings for example the learning of new words happen relatively fewer. In this style there is a balance between the auditory and visual aspect in the several exercises.

Teaching style 6

This teaching style is characterized by the great emphasis on the analysis of new words into components. There is not much attention for language development, the learning of new words and the synthesis of letters or sounds into words.

Teaching style 7

Centrally in this style is the reading of children. The teacher sets much tasks which demand that the children read. Reading comprehension gets also much attention. Task settings directed at the writing of the children and association exercises occur only a few times.

of the children self. Task settings directed at the learning of new words, the analysis and synthesis of these new words only happen a few times. The accent in analysis and synthesis lies on the visual aspects and also tasks for associate learning. Here too there is a relative lack of attention for language learning.

Teaching style 3

This teaching style is characterized by the fact that the teacher not only gives task settings on reading and writing but also sets tasks directed on the learning of new words and the analysis and synthesis of these words. There is also attention for technical exercises, which may be support the learning of reading.

Teaching style 4

This teaching style pays less attention at reading and exercises which support reading. The main emphasis lies on language development.

Teaching style 5

This style includes teaching behaviour characterized by task setting which concern the writing by teachers and children. Other task settings for example the learning of new words happen relatively fewer. In this style there is a balance between the auditory and visual aspect in the several exercises.

Teaching style 6

This teaching style is characterized by the great emphasis on the analysis of new words into components. There is not much attention for language development, the learning of new words and the synthesis of letters or sounds into words.

Teaching style 7

Centrally in this style is the reading of children. The teacher sets much tasks which demand that the children read. Reading comprehension gets also much attention. Task settings directed at the writing of the children and association exercises occur only a few times.